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RAIL IMPACT TESTS OF GONDOLA AND FLATCAR TRANSPORT OF EMPTY 20---ETC(U)
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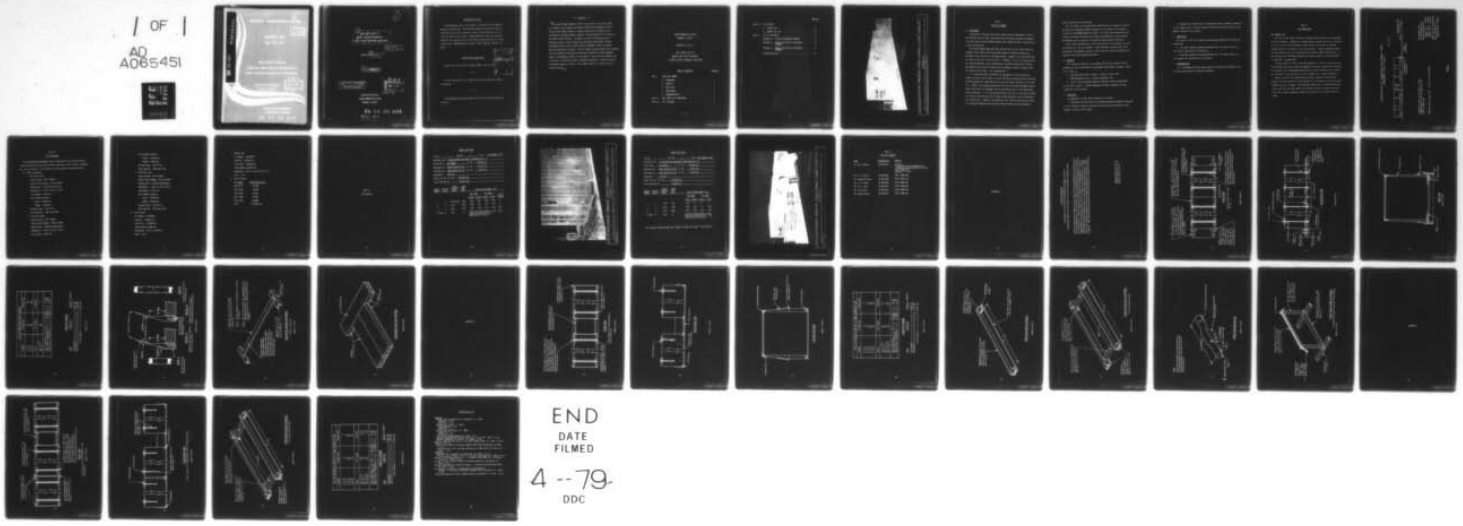

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REPORT NO.

EVT 20-77

RAIL IMPACT TESTS OF GONDOLA AND FLATCAR TRANSPORT OF EMPTY 20-FOOT INTERMODAL CONTAINERS

EVALUATION DIVISION

SAVANNA, ILLINOIS

(1)

(6) RAIL IMPACT TESTS OF
GONDOLA AND FLATCAR TRANSPORT
OF EMPTY 20-FOOT INTERMODAL CONTAINERS.

(12) 45 p.

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(11) 14 - 30 SEPTEMBER 1977

EVALUATION DIVISION
DARCOM AMMUNITION CENTER
SAVANNA, ILLINOIS

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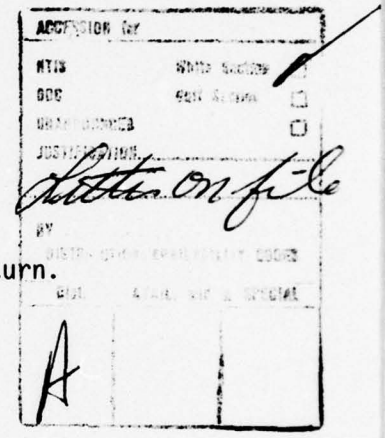

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* * * ABSTRACT * * *

The current CONUS commercial COFC railcar fleet of less than 7,000 cars probably could support the present Containerized Ammunition Distribution System (CADS) program if proper attention was directed to the existing car shortage problem. However, the fleet would fall far short in the event of mobilization. Therefore, to aid in alleviating the car shortage problem, it was proposed that available conventional flatcars and gondola cars be used to move 20-foot intermodal freight containers when the containers are empty. The rail impact testing program that resulted from this proposal evaluated the container blocking and bracing methods shown in the appendix section of this report. These restraint methods were successful in securing the empty intermodal containers in both the flatcar and gondola types of railcars. This report details the results of that testing program.

DARCOM AMMUNITION CENTER

SAVANNA, ILLINOIS

REPORT NO. EVT 23-77

RAIL IMPACT TESTS OF GONDOLA AND FLATCAR TRANSPORT OF EMPTY 20-FOOT INTERMODAL CONTAINERS

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PHOTOGRAPH NO. 1

Empty Milvans are secured on a flatcar by a wood dunnage system and 2-inch tie-down straps. Rail impact testing is accomplished by utilizing the switch engine shown here.

PART I

EXECUTIVE SUMMARY

A. BACKGROUND

A shortage of Container-on-Flatcar (COFC) type rail equipment is one of the problems that has been identified with the present Containerized Ammunition Distribution System (CADS) program, even though the CADS is operating on a very limited basis.

The current CONUS commercial COFC railcar fleet of less than 7,000 cars probably could support the present CADS program if proper attention was directed to the existing car shortage problem. However, the fleet would fall far short in the event of mobilization. Therefore, to aid in alleviating the car shortage problem, it was proposed that available conventional flatcars and gondola cars be used to move 20-foot intermodal freight containers when the containers are empty. See Photograph No. 1.

It is recognized that using COFC rail equipment for moving empty and loaded containers would result in a more efficient system than can be achieved by moving empties on conventional rail cars and loaded containers out on COFC cars. However, the proposed system will not tie up the COFC equipment moving empties when that rail equipment can be used 100 percent of the time moving loaded containers. It is also recognized that COFC cars do not require dunnaging, whereas conventional cars do require some dunnaging, with an associated cost (additional). However, the additional cost could be offset by the value of an improved readiness and responsive posture which must be obtained to

support mobilization requirements.

The rail impact test program that resulted from this proposal evaluates the effect of dunnaging methods developed by the Storage and Outloading Division of the DARCOM Ammunition Center. The tests were conducted by the Center's Evaluation Division and included investigations of both flatcars and gondola cars as a means of transporting empty 20-foot containers.

Due to their availability, a 53'6" flatcar and a 52'6" gondola car were the subjects of this test program. These dimensions contrast with those depicted in the appendix section of this report but serve to emphasize the flexibility of the outloading procedures.

B. AUTHORITY

This study was conducted in accordance with mission responsibilities delegated by the US Army Materiel Development and Readiness Command. Reference is made to:

1. Army Regulation 740-1, Chapter 4, dated 4 October 1974.
2. ARRCOM Regulation 10-17, dated 14 December 1977.
3. Letter, US Army Armament Materiel Readiness Command (DRSAR-TMA), 29 July 1977, subject: Proposal-Movements of Empty Intermodal Freight Containers by Rail Service.

C. OBJECTIVES

The objectives of this test program are as follows:

1. Determine the feasibility of transporting empty intermodal containers on rail flatcars, using the blocking and bracing techniques shown in the appendix section of this report.

2. Determine the feasibility of transporting empty intermodal containers in rail gondola cars, using the blocking and bracing techniques shown in the appendix section of this report.

D. CONCLUSIONS

The results of this rail impact testing program generated the following conclusions:

1. The empty container dunnaging methods were rail impact tested on a rail flatcar and proved to be effective.

2. The empty container dunnaging methods were rail impact tested in a rail gondola car and proved to be effective.

E. RECOMMENDATION

It is recommended that the empty container transporting procedures that were tested be adopted as approved procedures.

PART II

TEST PROCEDURES

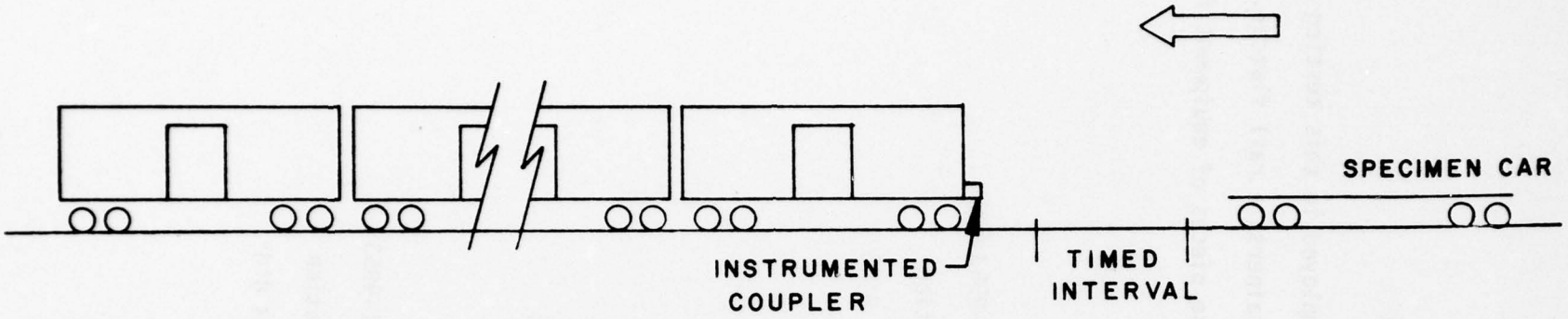
RAIL IMPACT TEST

The test car was impact tested in accordance with approved and standardized testing procedures. Impacting is accomplished by striking the test or specimen car into a line of five stationary, empty "buffer" cars which are coupled together with all air brakes in the "set" position. Forward impacting speeds are approximately four, six, and eight miles per hour (MPH) consecutively. At the conclusion of the forward impacting, a reverse impact at a minimum speed of eight MPH is accomplished.

A switch engine is used to start the specimen car rolling in the direction of the buffer cars along a 300-foot segment of straight, nearly level trackage. The specimen car is disengaged approximately 75 feet from the point of impact. and allowed to run freely into the line of buffer cars. Refer to Figure 1.

Impact velocities are determined by using an electronic counter which measures the time required for the specimen car to traverse an 11-foot distance immediately prior to impact. The recorded elapsed time is converted electronically into miles per hour (MPH) by utilizing a series of counters and oscillators and a digital computing counter which prints out the impact velocity in MPH.

ASSOCIATION OF AMERICAN RAILROADS (AAR)
STANDARD TEST PLAN



5 BUFFER CARS WITH DRAFT GEAR COMPRESSED AND AIR BRAKES IN A SET POSITION

BUFFER CAR TOTAL WT 227,900 LBS (APPROX)

SPECIMEN CAR IS RELEASED BY SWITCH ENGINE AT:

IMPACT NO. 1 4 MPH
IMPACT NO. 2 6 MPH
IMPACT NO. 3 8 MPH

THEN CAR IS REVERSED AND RELEASED AT

IMPACT NO. 4 8 MPH

FIGURE 1

PART III

TEST SPECIMENS

The transportation equipment that was employed in this testing program consisted of three 20-foot steel Milvan containers, a rail flatcar, a gondola car, and five boxcars. Descriptions of these pieces of equipment follow:

A. Milvan Containers

1. Serial No. 6381

   Specification: MIL-C-52661E

   Federal Stock Number: 8115-151-9953

   Manufacturer: Fab-Weld Corporation

   Dimensions: L 20'0", W 8'0", H 8'0"

   Tare Weight: 5,785 lbs.

   Gross Weight Capacity:

      Single: 44,800 lbs.

      Tandem: 33,600 lbs.

   Maximum Cargo: 39,015 lbs.

   Cube Capacity: 1280 cubic feet

2. Serial No. 6448

   Specification: MIL-C-52661E

   Federal Stock Number: 8115-151-9953

   Manufacturer: Fab-Weld Corporation

   Dimensions: L 20'0", W 8'0", H 8'0"

   Tare Weight: 5,785 lbs.

Gross Weight Capacity:

Single: 44,800 lbs.

Tandem: 33,600 lbs.

Maximum Cargo: 39,015 lbs.

Cube Capacity: 1280 cubic feet

3. Serial No. 8763

Specification: MIL-C-52661E

Federal Stock Number: 8115-151-9953

Manufacturer: Fab-Weld Corporation

Dimensions: L 20'0", W 8'0", H 8'0"

Tare Weight: 5,785 lbs.

Gross Weight Capacity:

Single: 44,800 lbs.

Tandem: 33,600 lbs.

Maximum Cargo: 39,015 lbs.

Cube Capacity: 1280 cubic feet

B. Rail Flatcar

Car Number: BN 606985

Capacity: 110,000 lbs.

Load Limit: 126,600 lbs.

Light Weight: 50,400 lbs.

Dimensions: 53'6"L by 10'6" W

Built: 2-50

C. Gondola Car

Car Number: BN 565799

Capacity: 154,000 lbs.

Load Limit: 163,900 lbs.

Light Weight: 56,100 lbs.

Dimensions: 52'6" L by 9'6" W by 4'6" H

Built: 3-72

D. Buffer Boxcars

Car Number	Light Weight (lbs.)
USAX 27179	46,000
USAX 27198	46,000
USAX 27085	46,000
USAX 27086	46,000
USAX 26033	43,900
TOTAL	227,900 lbs.

PART IV

TEST RESULTS

IMPACT TEST DATA

Load No. 1 Test No. 1 Date 14 September 1977

Specimen Load: 2 Empty Milvan Containers (Photograph No. 2)

Flatcar No. BN 606985 Lt. Wt. 50,400 lbs.

Container No. 6381 (B-End of car) Lt. Wt. 5,785 lbs.

Container No. 6448 (A-End of car) Lt. Wt. 5,785 lbs.

Dunnage Wt. 306 lbs.

Buffer Car Wt. (5 cars) 227,900 lbs.

Total Specimen Wt. 62,276 lbs.

IMPACT NUMBER	CAR END STRUCK	IMPACT VELOCITY (MPH)	A-END VOID (IN)	TOTAL DISPLACEMENT (IN)				
				No. 6381		No. 6448		B-End Dunnage
				B-End	A-End	B-End	A-End	
1	B	4.00 (est)	.125	.125	.250	.250	.250	0
2	B	6.16	.250	.250	.375	.375	.375	0
3	B	8.04	.750	.625	.750	.750	.750	.250
4 (Rev)	A	8.33	0	1.500-inch displacement in the opposite direction with a B-End void of 1 inch.				.250

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PHOTOGRAPH NO. 2

The header and back-up cleat assemblies at the left must withstand the severe longitudinal forces associated with switching operations. Side blocking and tie-down straps provide lateral and vertical restraint respectively.

IMPACT TEST DATA

Load No. 1 Test No. 2 Date 30 September 1977

Specimen Load: 2 Empty Milvan Containers (Photograph No. 3)

Gondola No. BN 565799 Lt. Wt. 56,100 lbs.

Container No. 6448 (A-End of car) Lt. Wt. 5,785 lbs.

Container No. 8763 (B-End of car) Lt. Wt. 5,785 lbs.

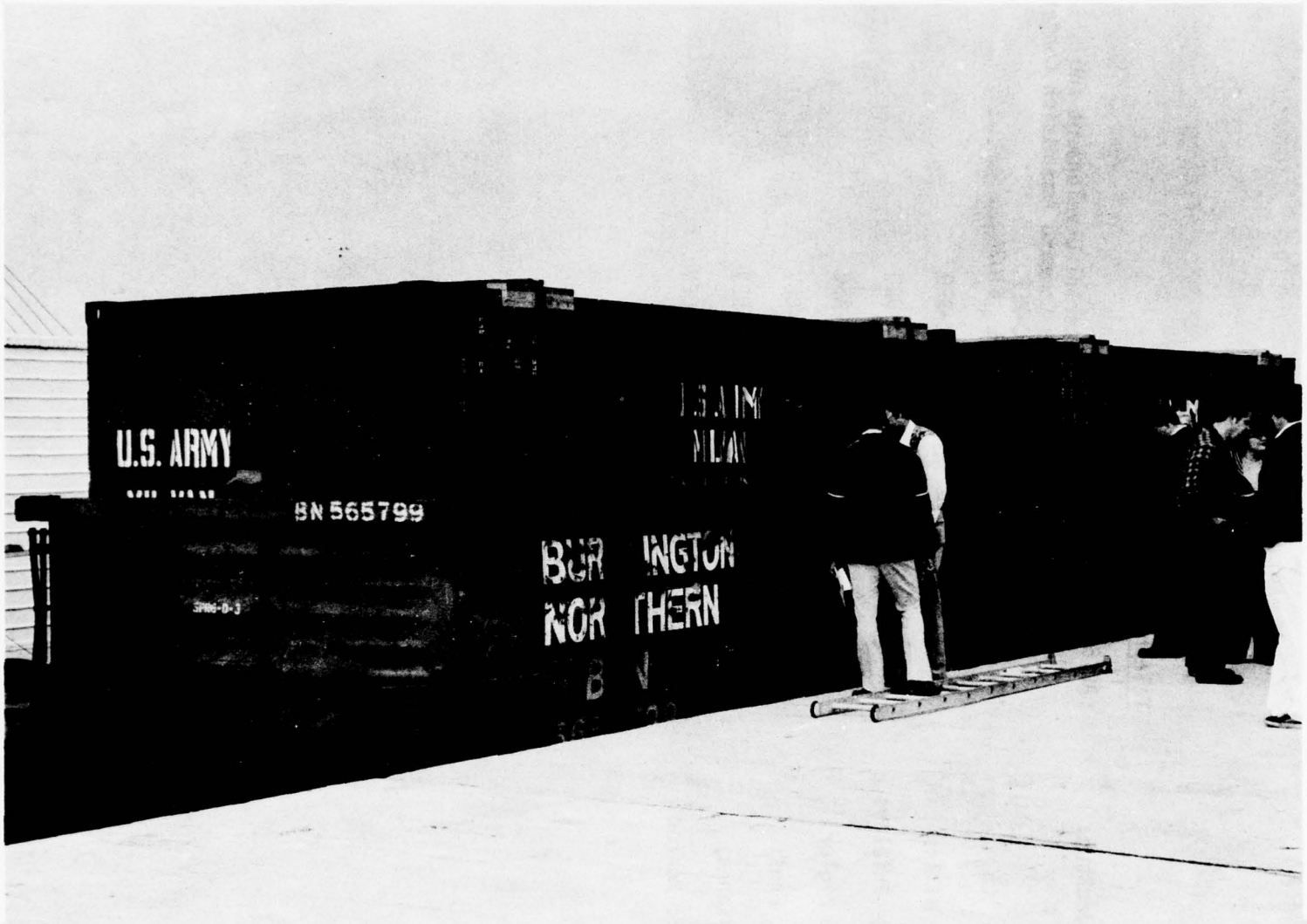
Dunnage Wt. 370 lbs.

Buffer Car Wt. (5 cars) 227,900 lbs.

Total Specimen Wt. 68,040 lbs.

IMPACT NUMBER	CAR END STRUCK	IMPACT VELOCITY (MPH)	A-END VOID (IN)	TOTAL DISPLACEMENT (IN)			
				No. 6448		No. 8763	
				A-End	B-End	A-End	B-End
1	A	3.96	.125	.125	0	0	0
2	A	6.72	.250	.875	.375	0	.125
3*	A	8.05	1.000	1.375	.375	.125	.250
4 (Rev)	B	8.03	0	1.25-inch displacement in the opposite direction with a 1.50 inch void at the A-End.			

* The forward (A-End) header was slightly cracked and bowed 1 inch forward.



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PHOTOGRAPH NO. 3

Empty Milvans were restrained in this gondola car using the procedures detailed in Appendices B and C of this report.

PART V

LIST OF ATTENDEES

Name	Telephone No.	Address
Mr. Eric Jackson	AU 585-8711	Director US Army Materiel Development and Readiness Command Ammunition Center ATTN: SARAC-MLE Savanna, IL 61074
Mr. D. I. Willis	AU 585-8563	ATTN: SARAC-DEO
Mr. George Phillips	AU 585-8528	ATTN: SARAC-DEO
Mr. H. J. Zigler	AU 585-8526	ATTN: SARAC-ASC
Mr. W. F. Ernst	AU 585-8711	ATTN: SARAC-DEV
Mr. Jack Kenna	AU 585-8741	ATTN: SARAC-DEV
Mr. Robert Monroe	AU 585-8751	ATTN: SARAC-DEV

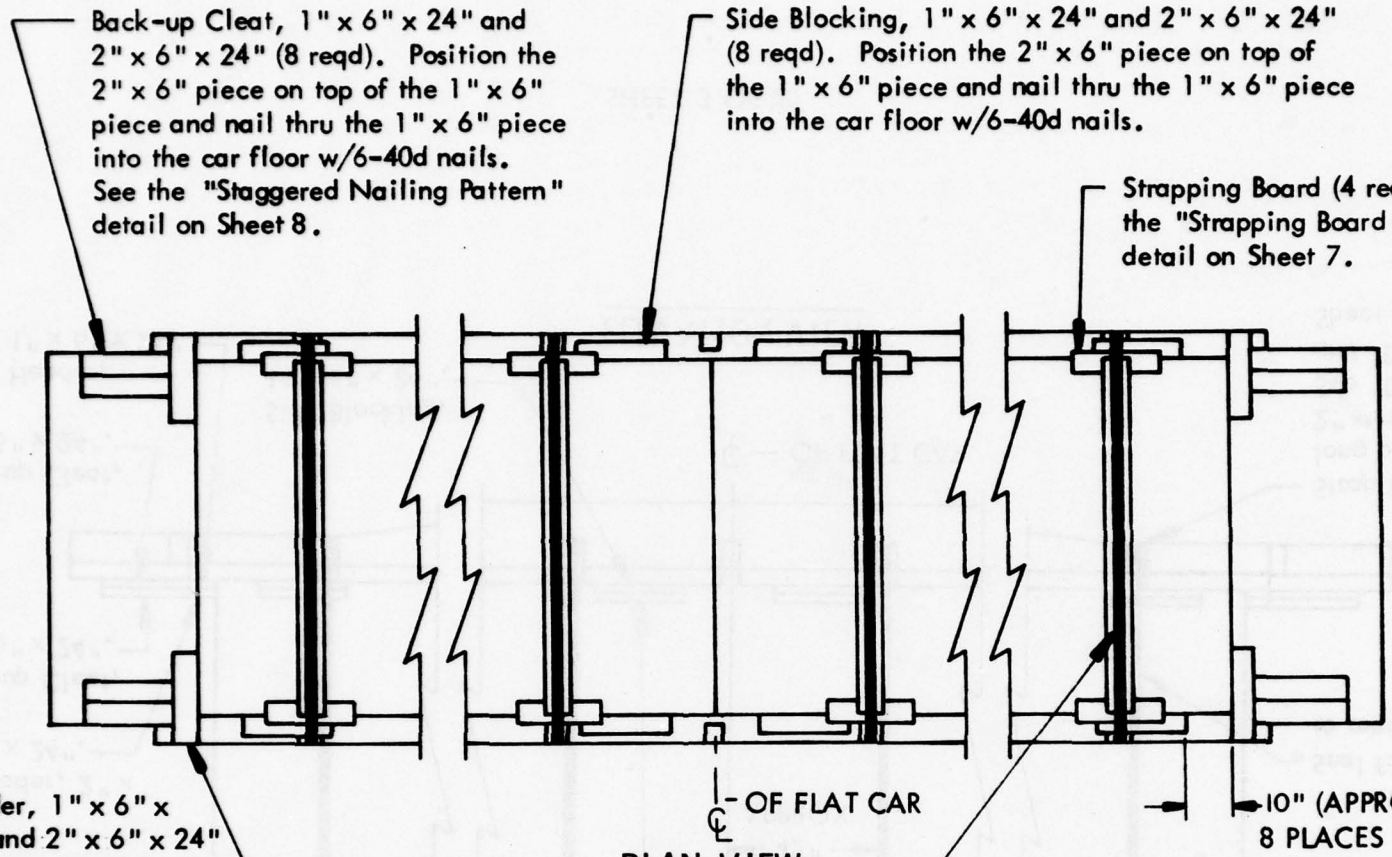
APPENDIX A

LOADING DIAGRAM

(PROPOSED OUTLOADING PROCEDURES FOR "EMPTY" 20-FOOT INTERMODAL FREIGHT CONTAINERS ON/IN FLAT CARS AND GONDOLA CARS)

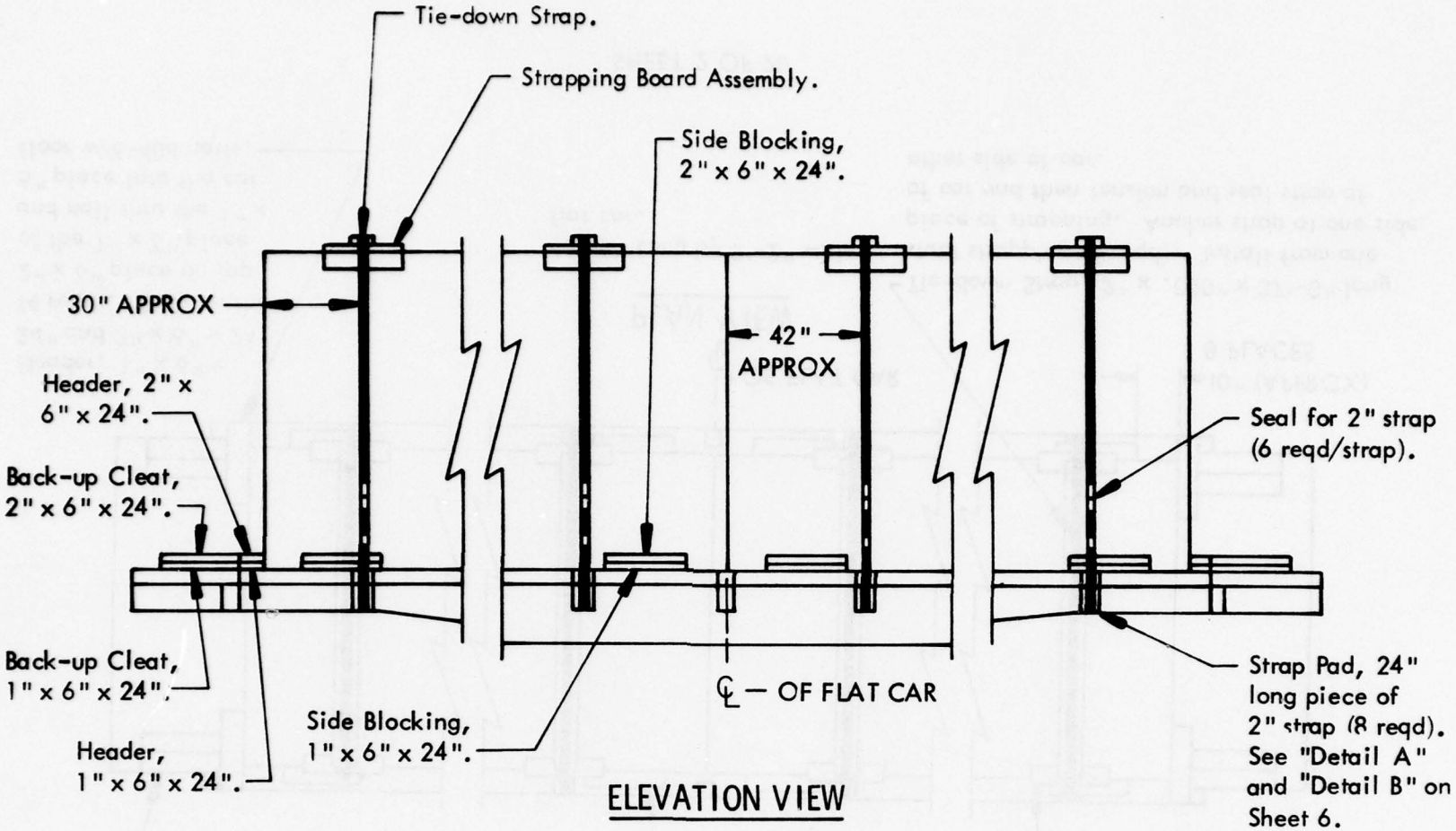
These procedures depict methods of securing "empty" 20-foot intermodal freight containers on/in flat cars and gondola cars. The first diagram depicts a two-container load on a 46'-6" long by 9'-2" wide flat car. A 45'-0" long flat car can also be used with these procedures. The second diagram depicts a two-container load in a 46'-6" long by 9'-2" wide gondola car. The third diagram depicts a three-container load in a 65'-6" long by 9'-2" wide gondola car. Gondola cars with 42" high walls are shown, however, cars with any height walls can be used. Longer and/or wider cars than specified can be used provided these procedures are followed as closely as possible. When wider gondola cars are used, floorline blocking will be lengthened accordingly.

Prepared During July 1977 by:
DARCOM Ammunition Center
Savanna, Illinois 61074

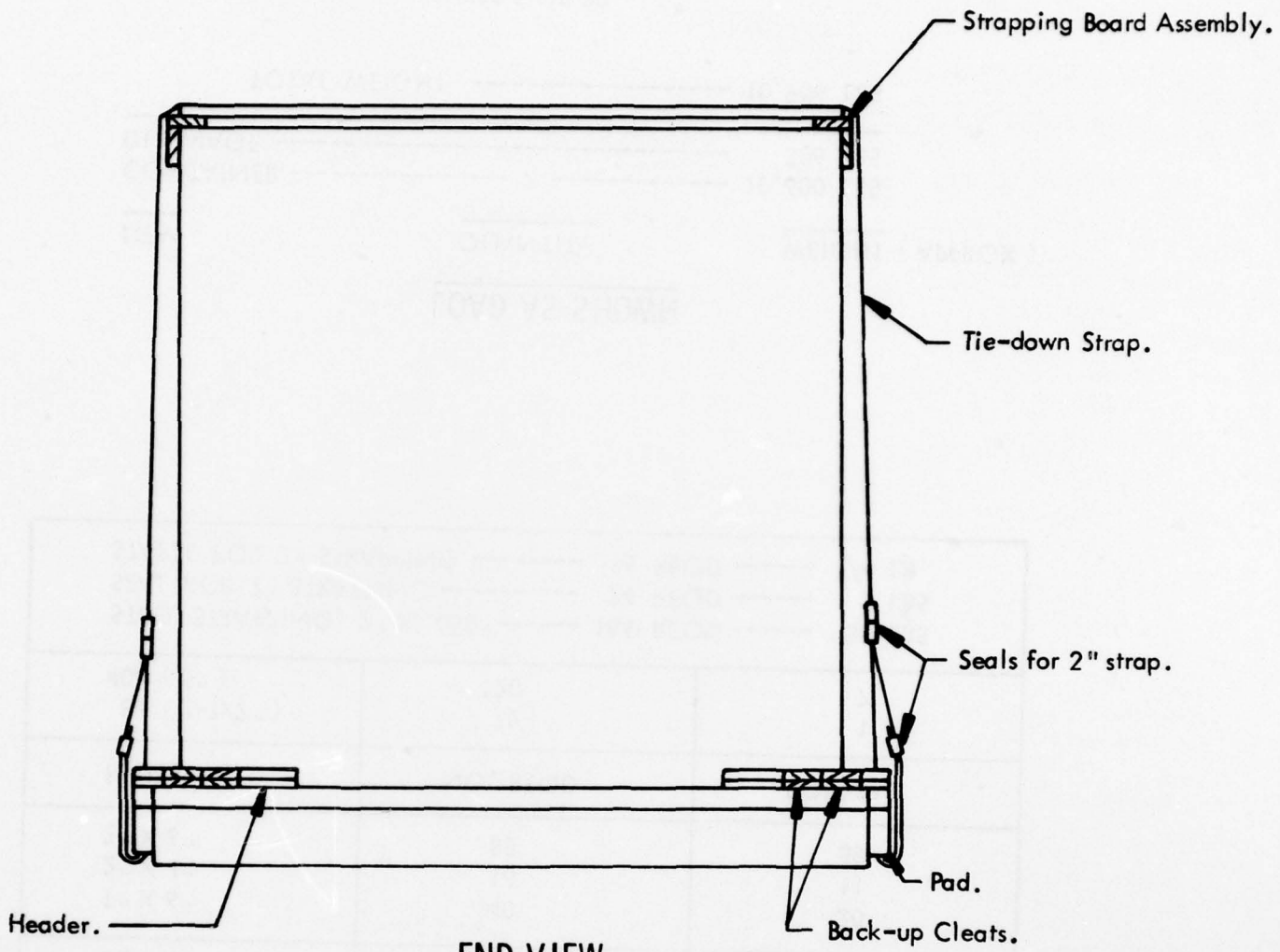


PLAN VIEW

46'-6" Long by 9'-2" wide flat car.



ELEVATION VIEW



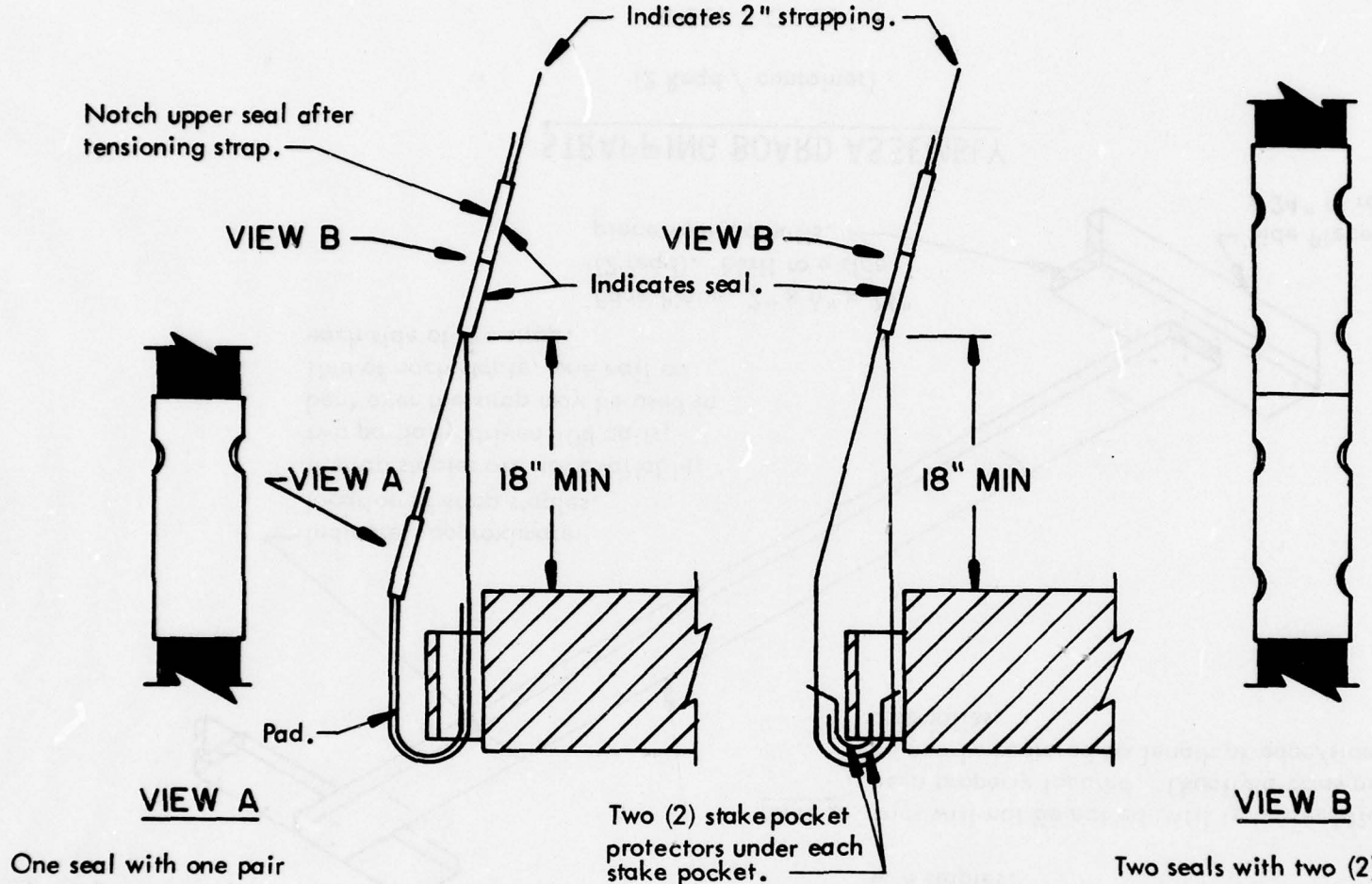
END VIEW

SHEET 4 OF 20

BILL OF MATERIAL FOR FLATCAR		
LUMBER	LINEAR FEET	BOARD FEET
1" X 6" 2" X 4" 2" X 6"	40 16 88	20 11 88
NAILS	NO. REQD	POUNDS
8d (2-1/2") 40d (5")	72 120	1 7
STEEL STRAPPING, 2" X .050" ------ 164' REQD ------ 55 LBS SEAL FOR 2" STRAPPING ---------- 24 REQD ------ 5 LBS STAPLE FOR 2" STRAPPING -------- 16 REQD ------ 1/4 LB		

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
CONTAINER	2	10,600 LBS
DUNNAGE		306 LBS
TOTAL WEIGHT		10,906 LBS



VIEW A

One seal with one pair of notches per seal.

VIEW B

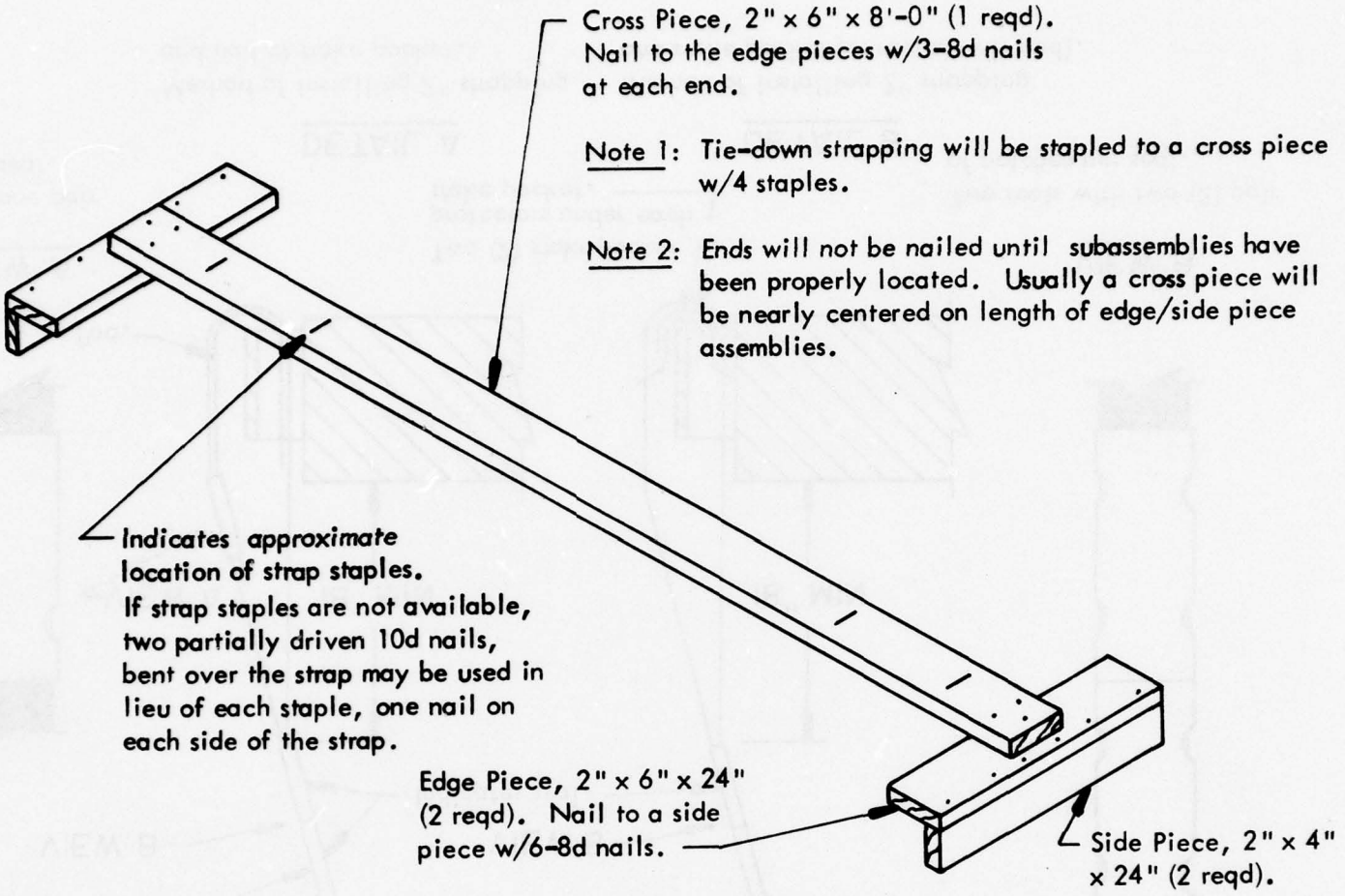
Two seals with two (2) pair of notches per seal.

DETAIL A

Method of installing 2" strapping and pad at stake pocket.

DETAIL B

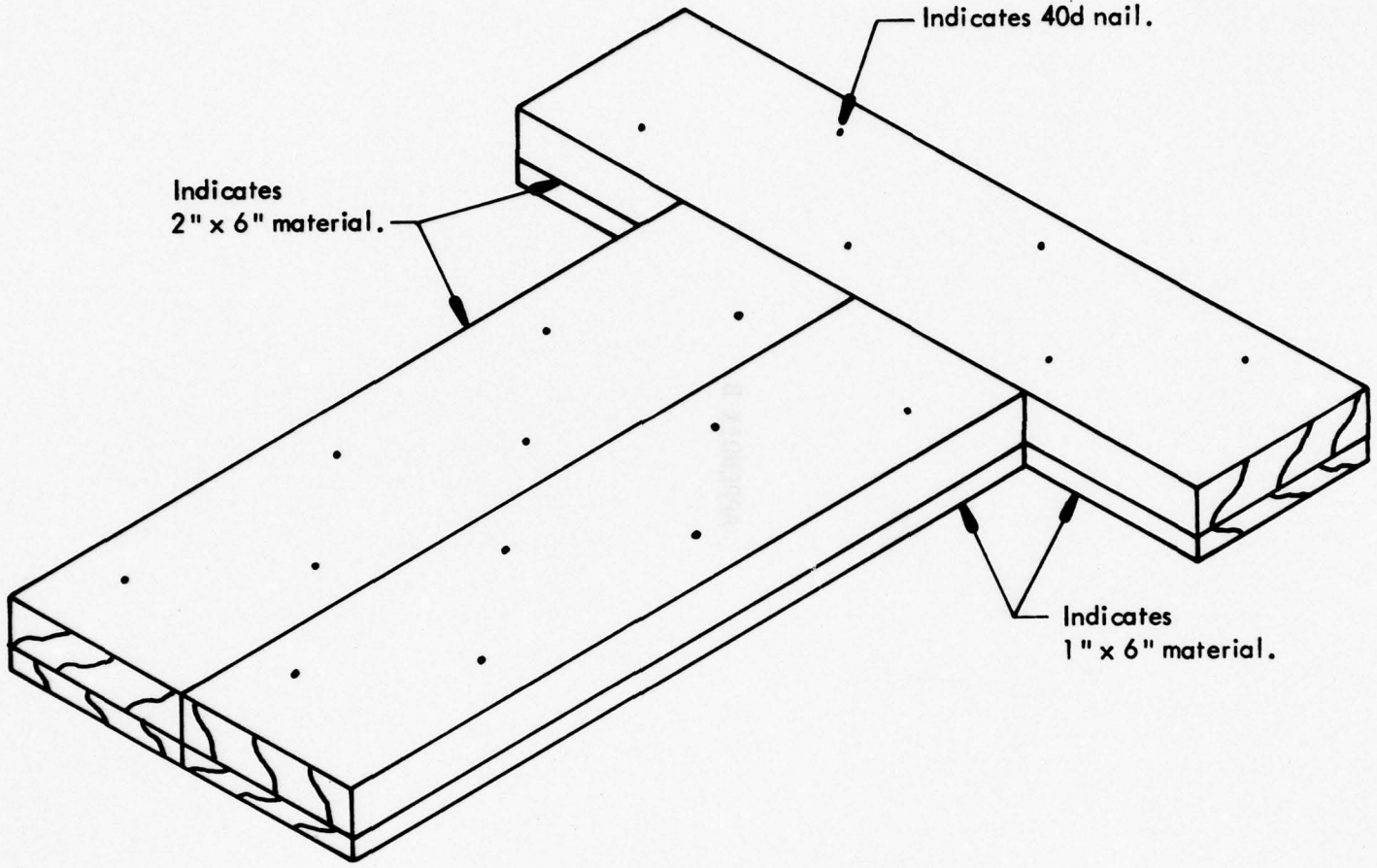
Method of installing 2" strapping and stake pocket protectors (alt pad).



STRAPPING BOARD ASSEMBLY

(2 Reqd / container)

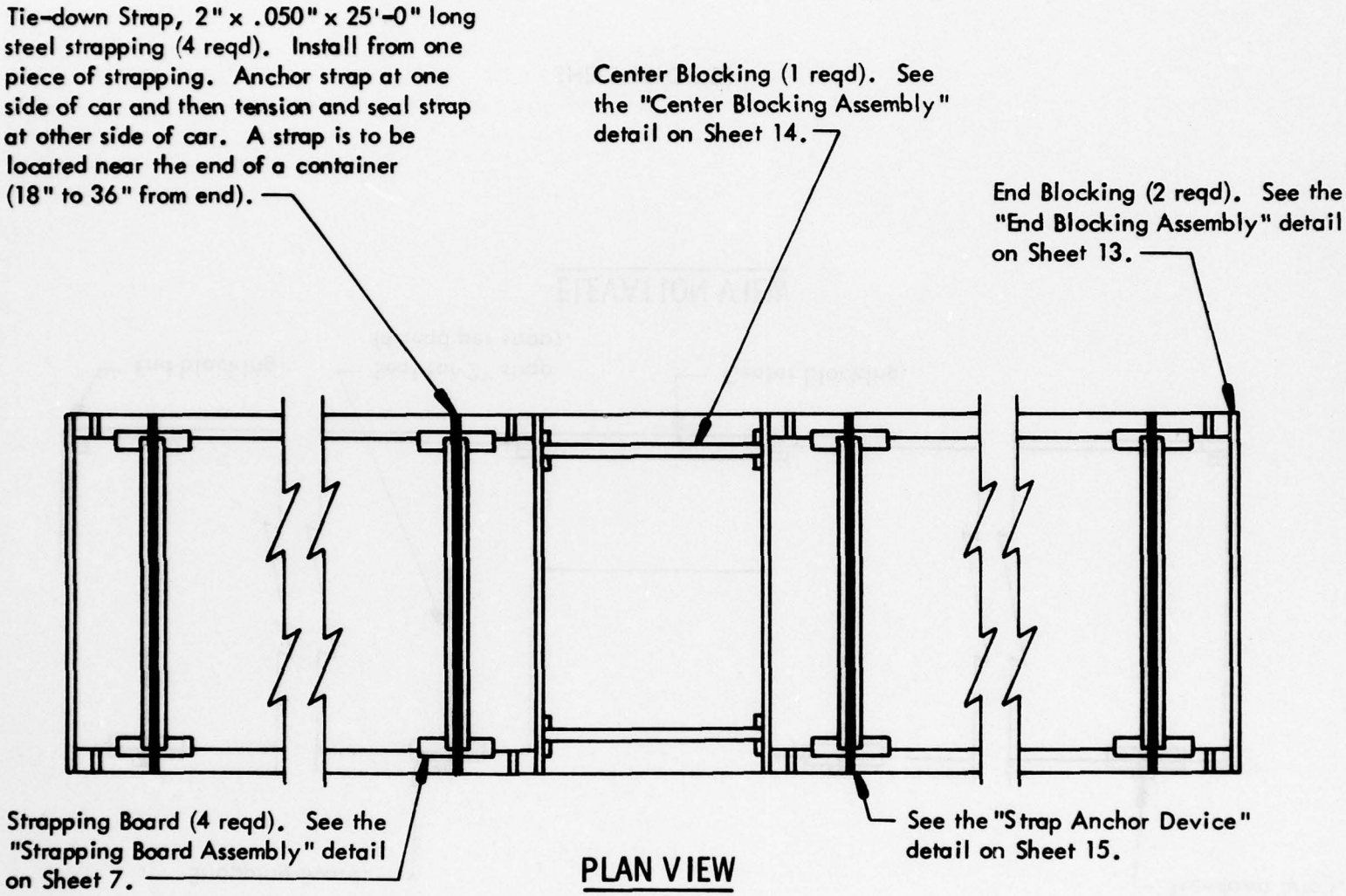
SHEET 7 OF 20



STAGGERED NAILING PATTERN

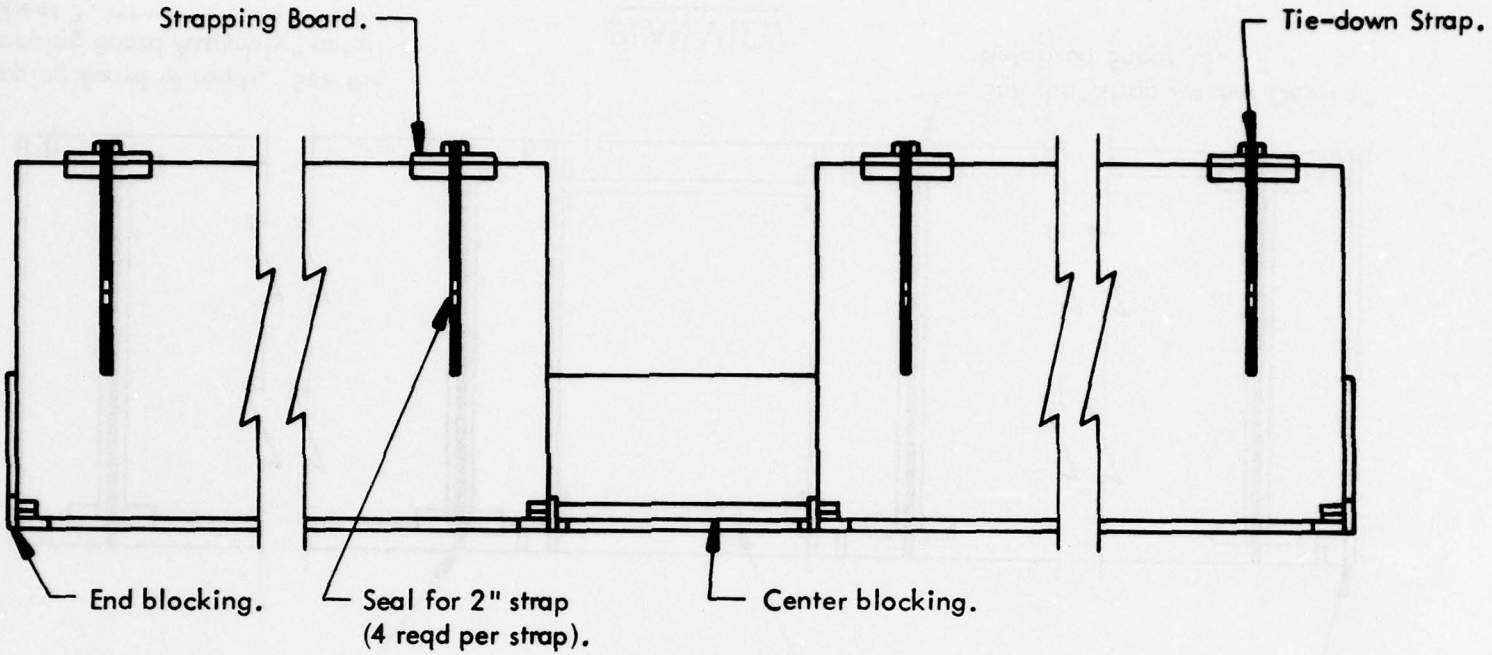
SHEET 8 OF 20

APPENDIX B

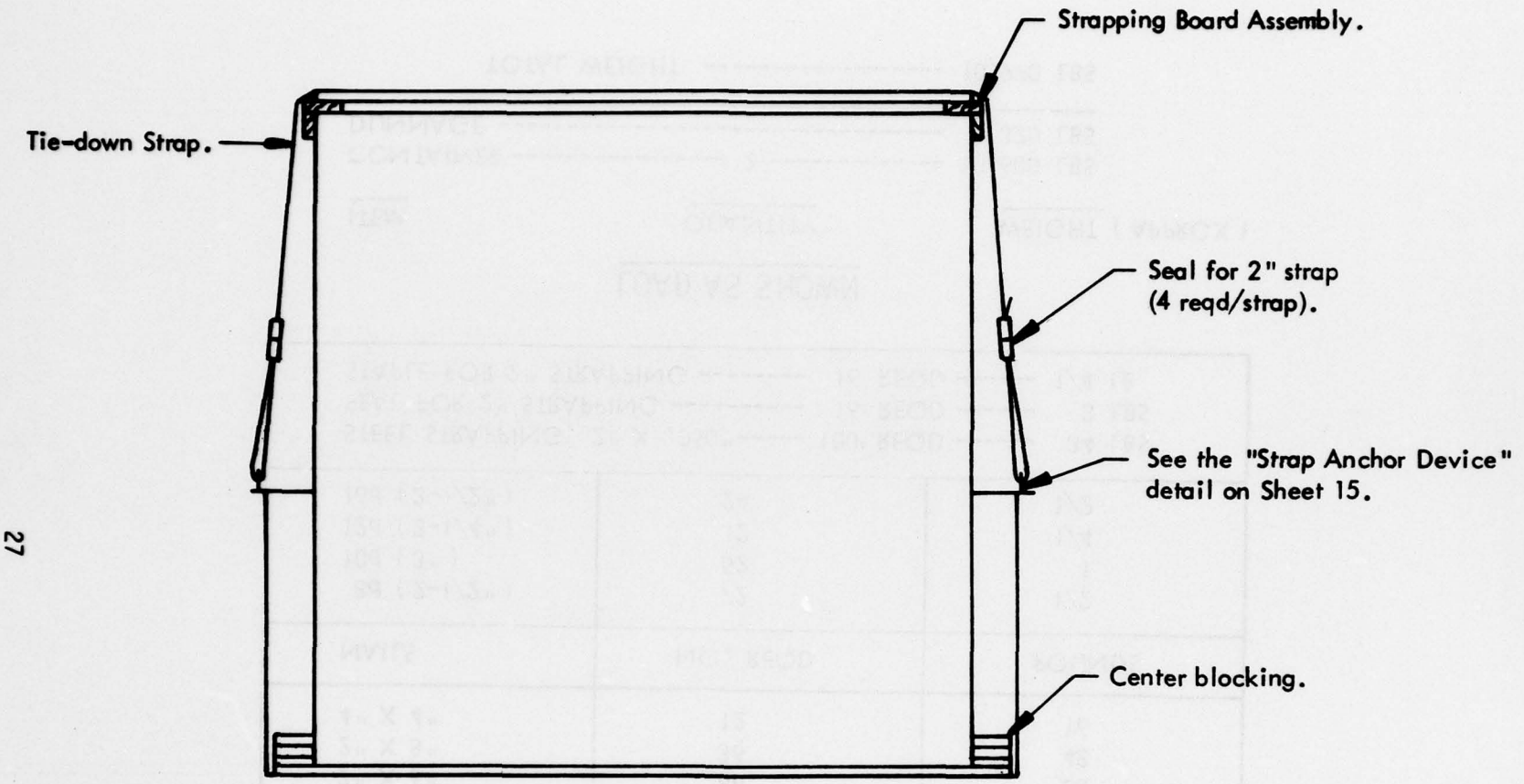


PLAN VIEW

46'-6" Long by 9'-2" wide gondola car with 42" high wall.



ELEVATION VIEW



TYPICAL SECTION

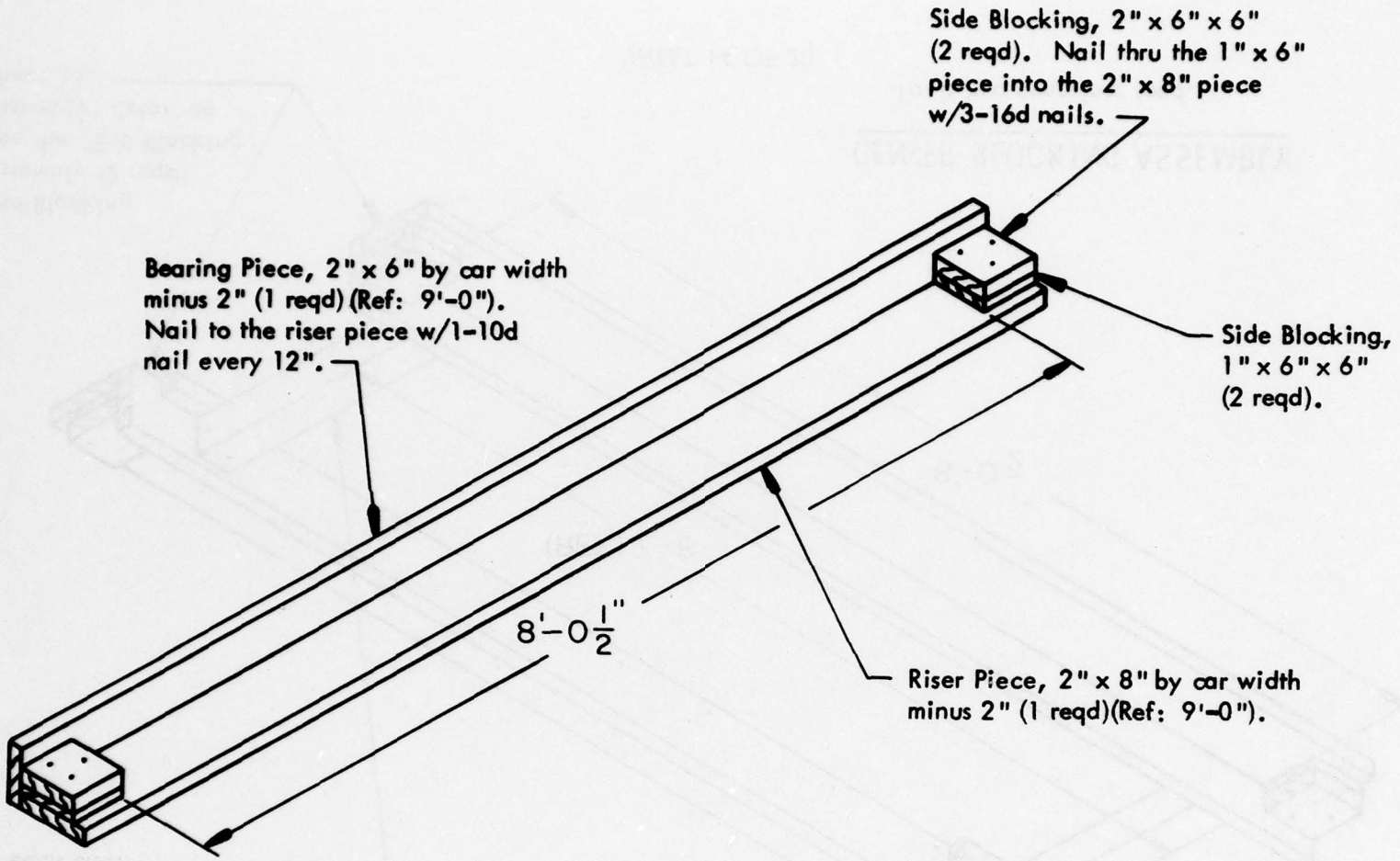
BILL OF MATERIAL FOR 46'-6" LONG GONDOLA CAR

LUMBER	LINEAR FEET	BOARD FEET
1" X 6"	4	2
2" X 2"	4	1
2" X 4"	16	10
2" X 6"	88	88
2" X 8"	36	48
4" X 4"	12	16
NAILS	**NO. REQD**	**POUNDS**
8d (2-1/2")	72	1/2
10d (3")	52	1
12d (3-1/4")	12	1/4
16d (3-1/2")	24	1/2

STEEL STRAPPING, 2" X .050"----- 100' REQD ------ 34 LBS
SEAL FOR 2" STRAPPING ---------- 16 REQD ------ 3 LBS
STAPLE FOR 2" STRAPPING -------- 16 REQD ------ 1/4 LB

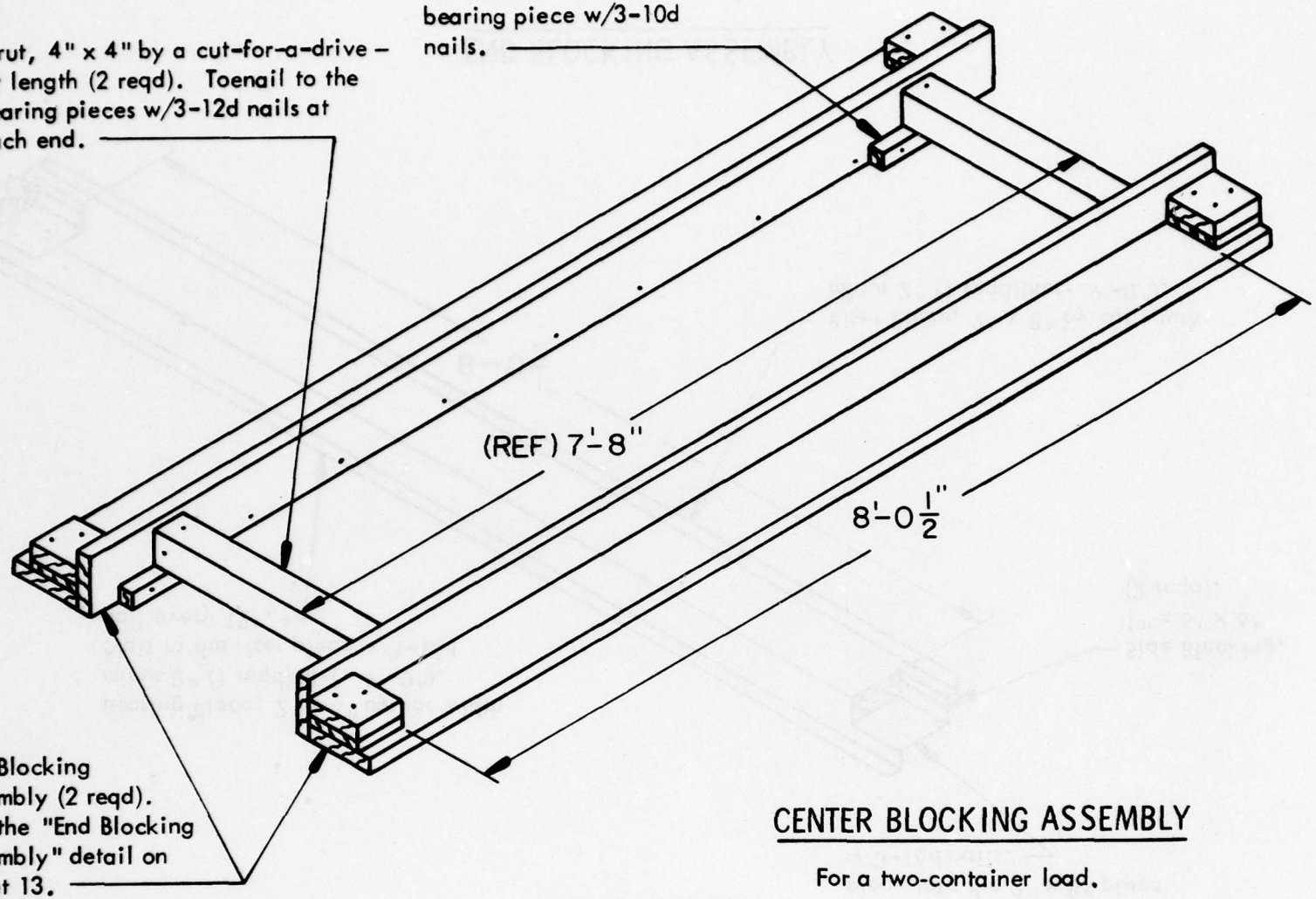
LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
CONTAINER	2	10,600 LBS
DUNNAGE		370 LBS
TOTAL WEIGHT		10,970 LBS



END BLOCKING ASSEMBLY

SHEET 13 OF 20

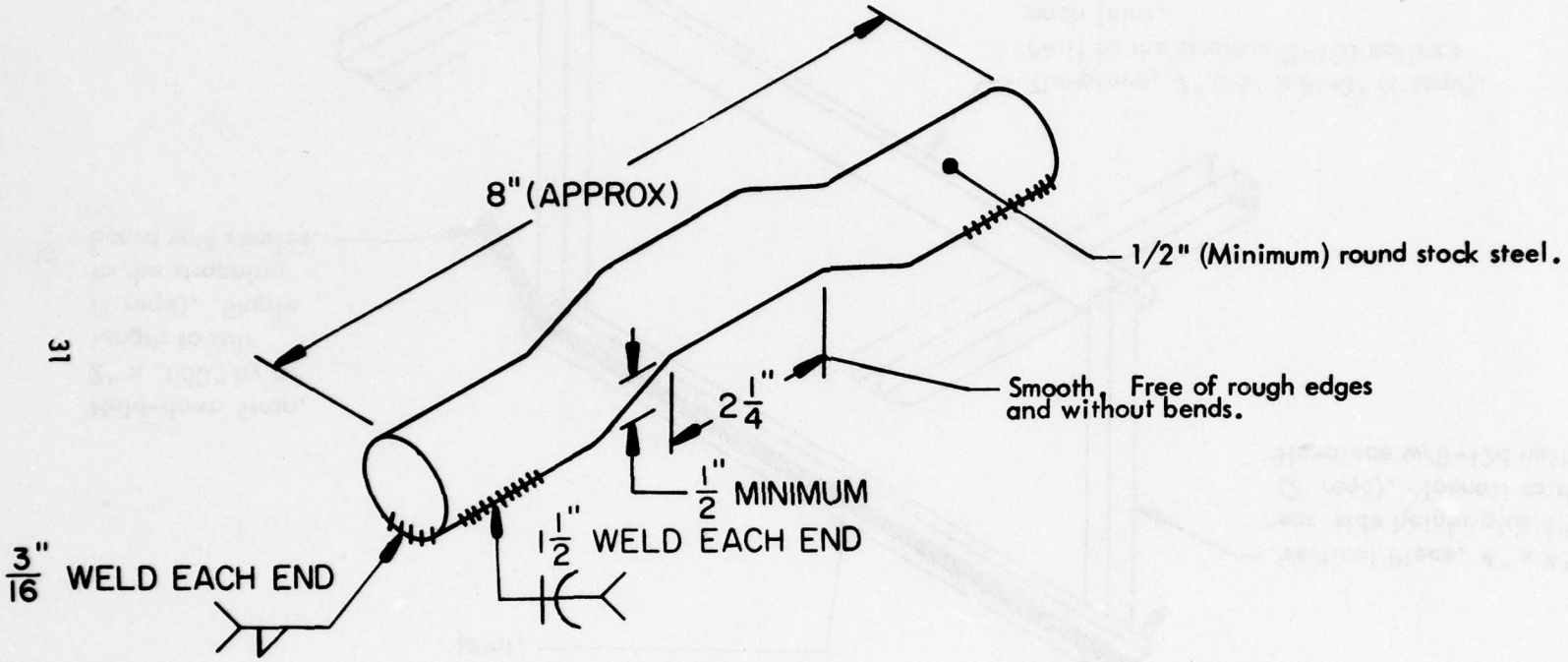


CENTER BLOCKING ASSEMBLY

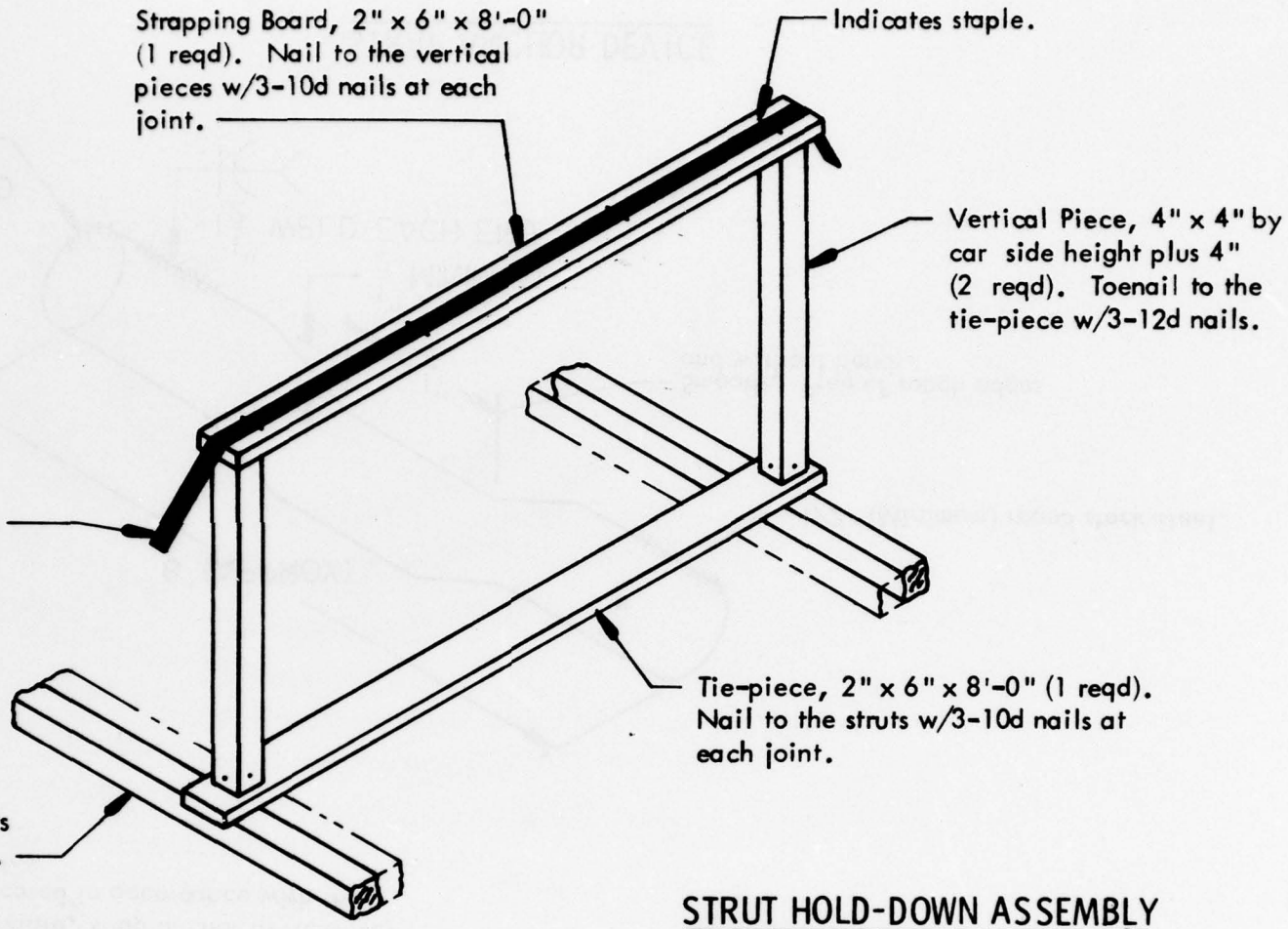
For a two-container load.

Note:

If cars with strap anchor tie-down facilities are not readily available, strap anchor devices may be locally fabricated in accordance with the detail shown below.



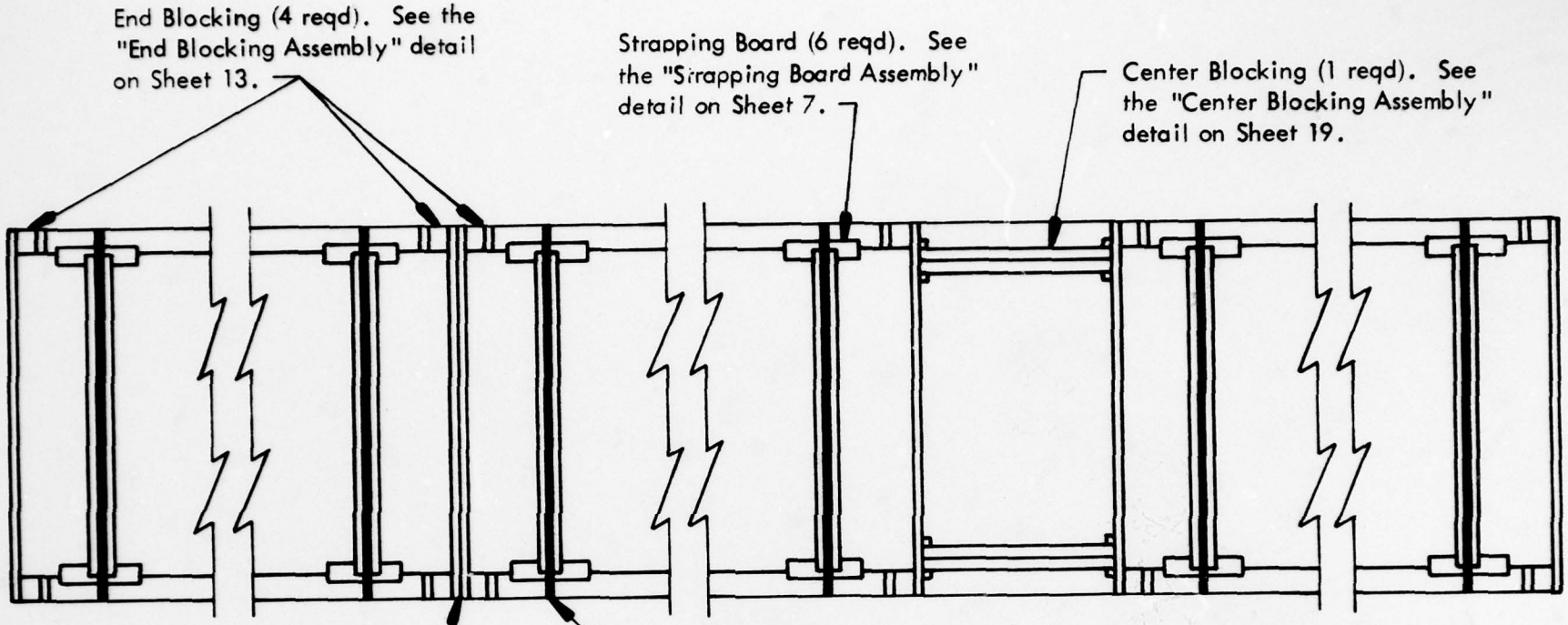
STRAP ANCHOR DEVICE



STRUT HOLD-DOWN ASSEMBLY

(1 Assembly required for every 72" of strut length).

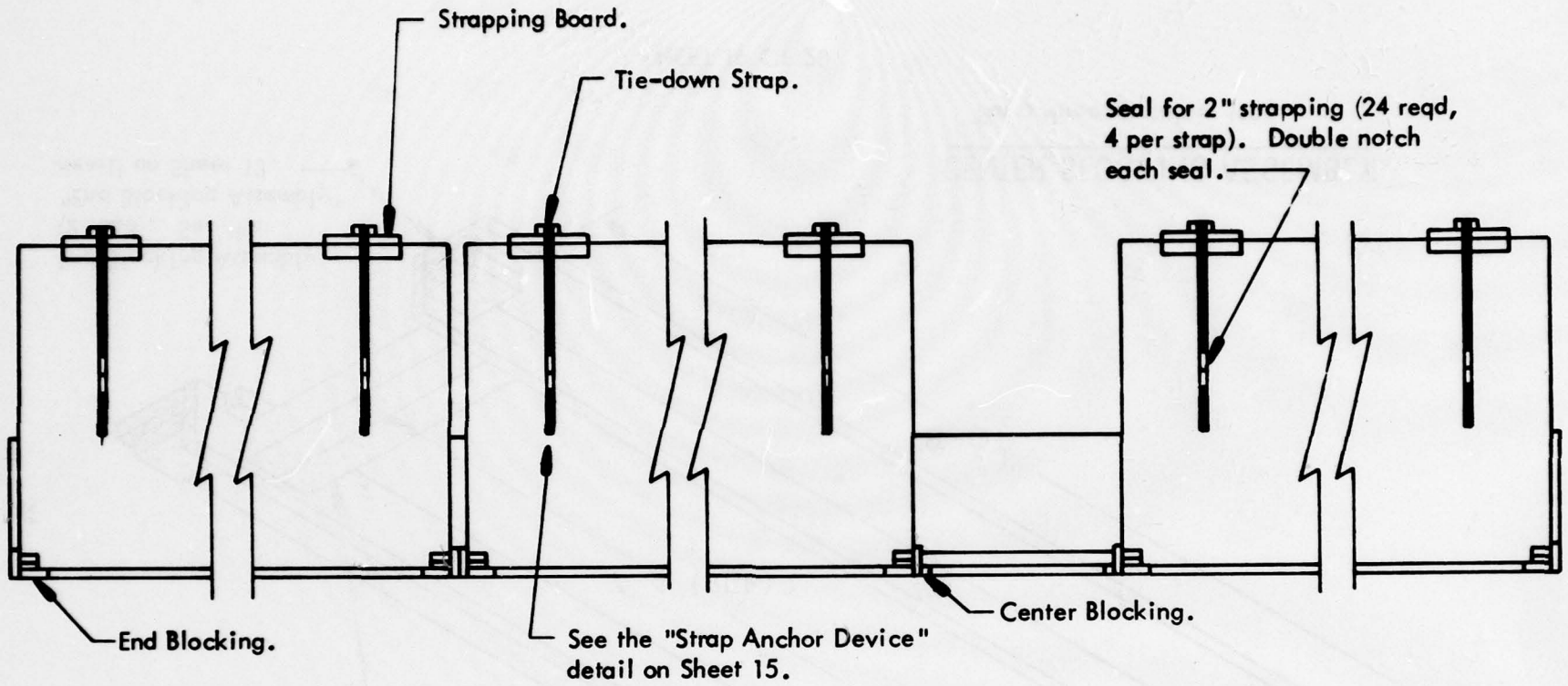
APPENDIX C



PLAN VIEW

65'-6" Long x 9'-2" wide gondola car with 42" high wall.

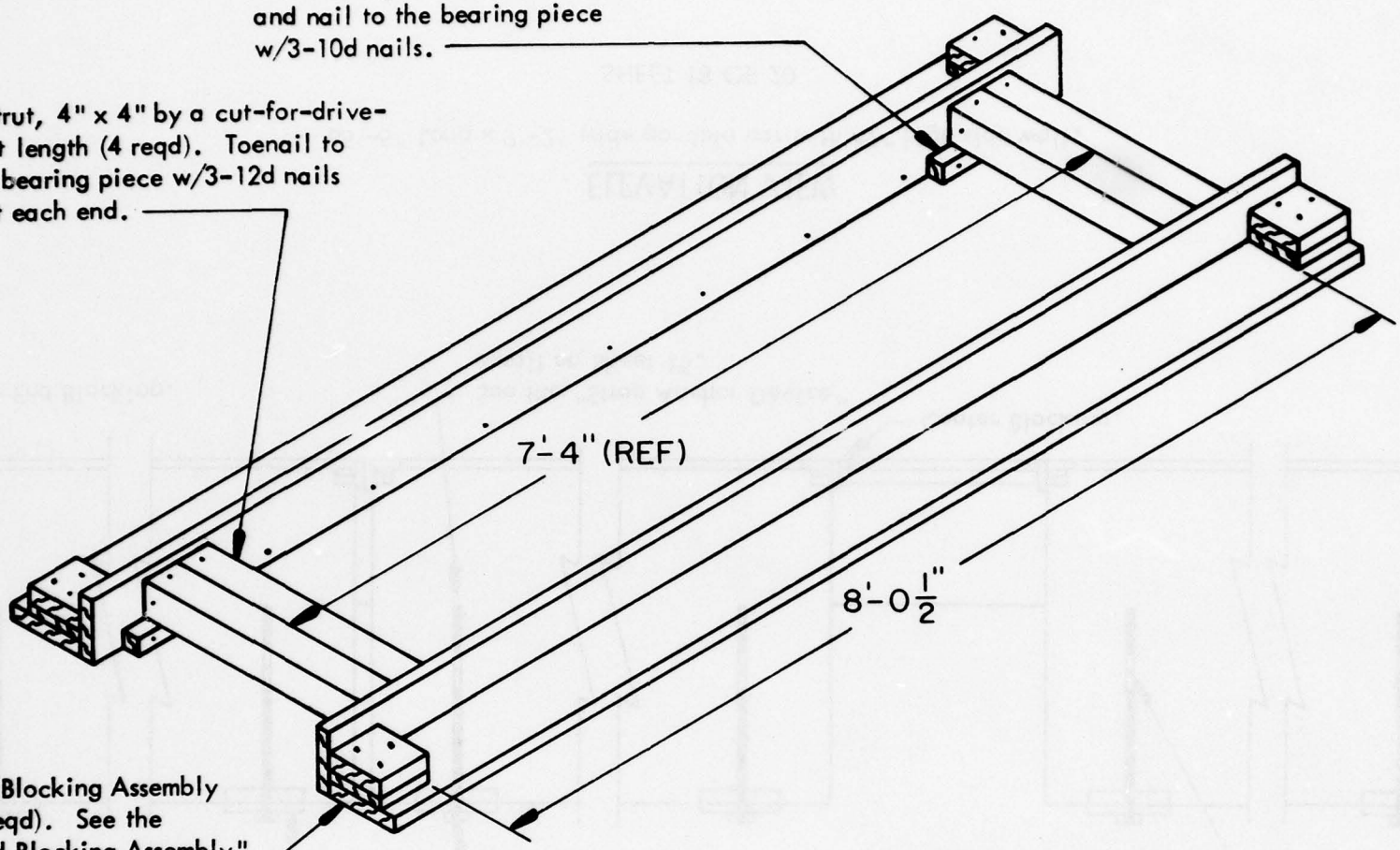
SHEET 17 OF 20



ELEVATION VIEW

65'-6" Long x 9'-2" wide gondola car with 42" high side wall.

SHEET 18 OF 20



CENTER BLOCKING ASSEMBLY

For a three-container load.

BILL OF MATERIAL FOR 65'-6" LONG GONDOLA CAR

LUMBER	LINEAR FEET	BOARD FEET
1" X 6"	6	3
2" X 2"	4	1
2" X 4"	24	16
2" X 6"	132	132
2" X 8"	54	72
4" X 4"	19	25
NAILS	**NO. REQD**	**POUNDS**
8d (2-1/2")	108	1-1/4
10d (3")	72	1-1/4
12d (3-1/4")	24	1/2
16d (3-1/2")	36	3/4

STEEL STRAPPING, 2" X .050" ---- 150' REQD ------ 50 LBS
SEAL FOR 2" STRAPPING ---------- 24 REQD ------ 5 LBS
STAPLE FOR 2" STRAPPING -------- 24 REQD ------ 1/2 LB

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
CONTAINER	3	15,900 LBS
DUNNAGE		557 LBS
TOTAL WEIGHT		16,457 LBS

DISTRIBUTION LIST

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USCG(MHM) 400 7th Street, SW, Washington, DC 20591 (2 cys)
US Marine Corps (CODE CSX - Mr. R. L. Duckett) Washington, DC 20380 (1 cy)
Bureau of Explosives, AAR, Mr. A. F. Grassmuck, Room 2200, 59 E. Van Buren, Chicago, IL 60605 (2 cys)
Mr. Wm. J. Burns, US DOT, Office of Hazardous Materials, Washington, DC 20590 (1 cy)
AFLC/DSP (AF Packaging Evaluation Agency - LTC Oberg) Wright-Patterson AFB, OH 45433 (1 cy)
CSSC Group, c/o Director, Transportation and Warehousing (OASDINL - LTC McElwain) RM 3C838, Pentagon Bldg, Washington, DC 20301 (1 cy)
Defense Documentation Center, Cameron Station, Alexandria, VA 22314 (1 cy)